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The procedures utilized in constructing test items designed to measure intermediate grade children's level of attainment of selected classificatory science concepts are described. Tests were prepared to measure children's level of concept mastery for 30 concepts, 10 each from the areas of biological science, earth science, and physical science. For each concept, an item was written to measure children's ability to perform each of the 12 tasks of a schema for testing the level of concept mastery. The items presented have been revised on the basis of a pilot study conducted with children in the public schools. (Author/PS)

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Working Paper No. 58

Items for Measuring the Level of Attainment of Selected Classificatory Science Concepts by Intermediate Grade Children

Report from the Project on a Structure of Concept Attainment Abilities and the Quality Verification Program

Wisconsin Research and Development
CENTER FOR COGNITIVE LEARNING

THE UNIVERSITY OF WISCONSIN
Madison, Wisconsin

U. S. Office of Education
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Contract OE 5-10-154

Working Paper No. 58

ITEMS FOR MEASURING THE LEVEL OF ATTAINMENT OF SELECTED CLASSIFICATORY SCIENCE CONCEPTS BY INTERMEDIATE GRADE CHILDREN

By Alan M. Voelker and Juanita S. Sorenson

Report from the Project on
A Structure of Concept Attainment Abilities
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The University of Wisconsin
Madison, Wisconsin

November, 1971

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The Wisconsin Research and Development Center for Cognitive Learning focuses on contributing to a better understanding of cognitive learning by children and youth and to the improvement of related educational practices. The strategy for research and development is comprehensive. It includes basic research to generate new knowledge about the conditions and processes of learning and about the processes of instruction, and the subsequent development of research-based instructional materials, many of which are designed for use by teachers and others for use by students. These materials are tested and refined in school settings. Throughout these operations behavioral scientists, curriculum experts, academic scholars, and school people interact, insuring that the results of Center activities are based soundly on knowledge of subject matter and cognitive learning and that they are applied to the improvement of educational practice.

This Working Paper is from the Project on the Structure of Concept Attainment Abilities in Program 1. It is the result of a cooperative effort among the staffs from the Concept Attainment project, Project 203--Elementary Science--in Program 2 and the Technical Development Program. The Concept Attainment staff and the staff from Project 203 identified the basic concepts in science at intermediate grade levels and Project 203 staff and staff from the Technical Development Program developed the tests to measure concept attainment. The tests will be used to facilitate basic and development-based research in Project 203 and to study the relationships among cognitive abilities and learned concepts in various subject matter areas. The outcome from the Concept Attainment project will be a formulation of a model of structure of abilities in concept attainment in a number of subjects, including mathematics, language arts, and social studies, as well as science.

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ABSTRACT

The procedures utilized in constructing test items designed to measure intermediate grade children's level of attainment of selected classificatory science concepts are described. Tests were prepared to measure children's level of concept mastery for 30 concepts, 10 each from the areas of biological science, earth science, and physical science. For each concept, an item was written to measure children's ability to perform each of the 12 tasks of a schema for testing the level of concept mastery. The items presented have been revised on the basis of a pilot study conducted with children in the public schools.

I

INTRODUCTION

One of the major activities of the Wisconsin Research and Development Center for Cognitive Learning is to engage in mutually beneficial projects between Program 1: Conditions and Processes of Learning and Program 2: Processes and Programs of Instruction. The test items presented in this working paper are the result of such a cooperative venture; the initial outcome of cooperative efforts between Project 111: A Structure of Concept Attainment Abilities and Project 203: Prototypic Instructional Systems: Elementary Science.

The general objectives of Project 111 are, in cooperation with other projects in Program 1 and projects in Program 2,

1. To identify basic concepts in language arts, mathematics, science, and social studies appropriate at a given grade level.
2. To develop tests to measure achievement of these concepts.
3. To identify reference tests for cognitive skills.
4. To study the relationships among learning concepts in certain subject-matter areas.
5. To formulate a model or structure of abilities in concept attainment.

The general objectives of Project 203 are

1. To determine which science concepts are appropriate for inclusion in the K-6 science program.

2. To develop instructional materials to effect the learning of these concepts.

3. To develop an evaluation system and corresponding assessment materials for measuring the attainment of the aforementioned concepts.

4. To determine, through related research, how well children of specified characteristics can learn these concepts under specified instructional conditions.

5. To determine the relationships between science concept learning and concept learning in other subject-matter areas.

An examination of the objectives of these two projects indicates that there is a commonality in objectives which provides the opportunity for cooperative research and development efforts and, in actuality, necessitates that this be done to maximize the efficiency of both groups. This paper describes the procedures employed in constructing test items to be used in facilitating a study designed to measure the level of concept mastery of selected classificatory[1] science concepts, a project which facilitates the work of both projects.

---

[1] A classificatory concept is defined as one possessing three characteristics:

a. There is more than one example of the concept.
b. The properties (attributes) of the concept can be described.
c. The concept can be labeled (named) by a word or a compound word.

II

PROCEDURES

SOURCES OF CONCEPTS

The concepts for which test items were written were selected by analyzing the fourth grade text from each of six commonly used elementary school science textbook series. (See Appendix A.) Each classificatory science concept in each of these six texts was identified and classified as predominantly a biological, earth, or physical science concept. A sample of ten concepts was randomly selected from each of the three lists for analysis according to a system reported in Working Paper No. 57 (Voelker, Sorenson, & Frayer, in press).

CONCEPT ANALYSIS

Each of the 30 concepts was analyzed in the following manner.

1. Relevant and irrelevant attributes of the concept were identified.
2. Supraordinate, coordinate, and subordinate concepts of the given concept were identified.
3. Criterial attributes of the concept were identified.
4. A definition of the concept was formulated.
5. Examples and non-examples of the concept were listed.

The results of these analyses provided the framework for item construction.

Those concepts that did not fit the definition of classificatory concept, for which the concept analysis could not be completed, and for which an appropriate item for each of the 12 tasks of the schema (See Section on Concept Mastery Tests which follows) could not be written were randomly replaced until a concept mastery test was completed for each of 30 concepts.

CONCEPT MASTERY TESTS

A 12-item test was written for each of the 30 concepts. The technique employed was to write one item to measure the attainment of each of the 12 tasks of a schema developed to measure the level of concept attainment (Frayer, Fredrick, & Klausmeier, 1969). The 12 tasks are as follows:

1. Given the name of an attribute, select an example of the attribute.
2. Given an example of an attribute, select the name of the attribute.
3. Given the name of a concept, select the example of the concept.
4. Given the name of a concept, select the non-example of the concept.
5. Given an example of the concept, select the name of the concept.
6. Given the name of the concept, select the relevant attribute.
7. Given the name of a concept, select the irrelevant attribute.
8. Given the meaning of a concept, select the name of the concept.

9. Given the name of a concept, select the meaning of the concept.
10. Given the name of a concept, select the supraordinate concept.
11. Given the name of a concept, select the subordinate concept.
12. Given two concepts, select the principle relating them.

ITEM WRITING PROCEDURES

The initial draft of the items was prepared by a science education specialist and reviewed by the principal investigator for science. When agreement on the appropriateness of the items was reached between these two parties, the items were further reviewed by a group of graduate students in science education, each a specialist in biological science, earth science, and/or physical science. Their suggestions were considered in making further revisions of the items.

The items were then reviewed by an item review committee consisting of experienced elementary school teachers, a specialist in concept learning, and a specialist in tests and measurements. Comments made by this group were considered in making any further item revisions.

III

ITEM REVISION

ITEM TRYOUTS

A pilot study was conducted to obtain data to be used in revising the test items prior to their use in conducting research studies or furthering development work. A total of five 72-item tests was administered to every subject. Each test consisted of the 12 items for six of the 30 concepts. Items were randomly assigned to positions on the tests.

The test reliabilities for all of the biological science concepts, 9 of the 10 earth science concepts, and 9 of the 10 physical science concepts exceeded 0.50. (See Appendix B.) As indicated by Harris (1968) a test reliability in excess of 0.50 is respectable for a group test. It should be noted that tests for 24 of the 30 concepts were, of necessity, administered in a school system where a majority of the students tested had median scores above the 90th percentile on the Iowa Tests of Basic Skills. Generally, these concept tests had high means and low variance which has a tendency to decrease test reliability. Both of the tests having a reliability less than 0.50 were included in this group. Note also that these are only 12-item tests.

REVISION PROCEDURES

The data from the previously described pilot study were used to revise the test items. The item writer, the principal investigator from Project 203 (Science) and the project manager for the Concept Attainment Abilities project conducted the revision by examining concept test reliabilities and individual item characteristics. Items were also re-checked for subject-matter validity. The effect of these modifications on reliabilities of concept tests will be reported as part of ensuing studies.

IV

SUGGESTIONS FOR USE OF ITEMS

POTENTIAL USES

The elementary school teacher may be able to use the items presented in this paper in several ways.

1. They could be used to assess children's level of concept attainment prior to and following instruction.
2. One or more of the items for a concept might be used in constructing localized tests of concept attainment.
3. Based on the results obtained in using these tests with several groups of children in a local situation it would be possible to establish reasonable learning expectations pertinent to selected concepts.

Research and development specialists may also find the items to be of use in facilitating their work.

LIMITATIONS

It should be pointed out that the items presented in this document were primarily constructed to facilitate data collection to test a schema for measuring the level of concept mastery. The degree to which they measure students' learning of a given concept and its relationship to other concepts is, therefore, restricted to the specified

tasks of the schema. Teachers and others who choose to make use of part or all of a concept test should consider this fact in determining whether these items and/or tests are an adequate and appropriate measure of the achievement of the local concept attainment objectives. These tests are not, in any way, intended to be prescriptive.

While the tests have potential for use as preinstructional and postinstructional instruments, the user should note that the test reliabilities, at present, are adequate only for use in group work. The reliabilities for a majority of the concept tests are below the generally accepted minimum for use for individuals. Therefore, the tests should <u>not</u> be used to make decisions regarding an individual student's educational progress or to assign him a grade.

V

TESTS OF CONCEPT MASTERY

Concepts for which tests of concept mastery have been written are presented in Table 1.

Table 1

Biological, Earth, and Physical Science Concepts for Which Tests of Concept Mastery Have Been Prepared

Biological	Earth	Physical
Bird	Cloud	Conductor
Cell	Core (Earth)	Evaporation
Fish	Fossil	Expansion
Heart (Human)	Glacier	Friction
Invertebrate	Meteor	Liquid
Lens (Eye)	Moon	Melting
Lungs	Planet	Molecule
Mammal	Sedimentary Rock	Solid
Muscle	Volcano	Sound
Pore (Skin)	Wind	Thermometer

The pages which follow present the items in alphabetical order by area, concepts alphabetically within an area, and test items for each concept in order according to the 12 tasks of the concept attainment schema.

Biological Science

BIRD

1. Which arrow points to feathers?

2. The arrow points to:

   A. scales

   B. feathers

   C. hair

3. Which picture shows a bird?

A.

B.

C.

4. Which of these pictures does <u>NOT</u> show a bird?

A.

B.

C.

5. This picture shows a:

A. mammal

B. reptile

C. amphibian

D. bird

6. <u>All</u> birds:

A. eat worms

B. fly to warmer climates in winter

C. are covered with feathers

D. are brown with an orange breast

7. Which of these is <u>NOT</u> true for all birds?

A. They build their nests in trees.

B. They are warm-blooded.

C. They are covered with feathers.

D. The female lays eggs.

8. Animals which are warm-blooded, covered with feathers and the female lays eggs are called:

A. amphibians

B. fish

C. birds

D. mammals

9. Birds are animals which are:

A. warm-blooded, covered with hair, and feed the young on the mother's milk

B. cold-blooded, covered with feathers, and the female lays eggs

C. cold-blooded, covered with scales, and the female lays eggs

D. warm-blooded, covered with feathers, and the female lays eggs

10. A bird is a kind of:

A. animal

B. mammal

C. reptile

D. amphibian

11. Which of these is a kind of bird?

A. mouse

B. sparrow

C. squirrel

D. bat

12. What is true for birds and gizzard?

A. The gizzard helps birds keep their balance.

B. Birds use a gizzard to help digest food.

C. The gizzard is a sense organ in birds.

D. Birds use a gizzard to find worms.

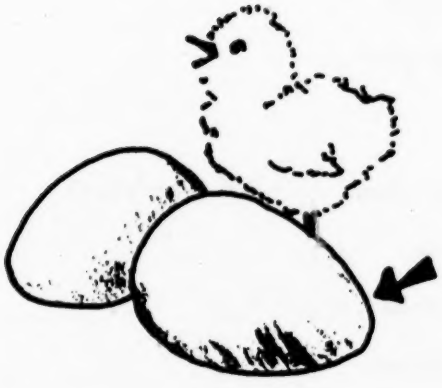
CELL

1. Which arrow points to something which has a wall or membrane around it?

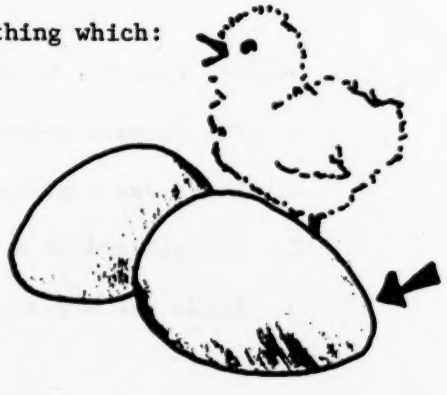
A.

B.

C.



2. The arrow in this picture points to something which:



A. has been torn into pieces

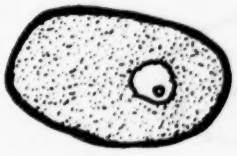
B. has a wall or membrane around it

C. relaxes and contracts

D. has no definite size

3. Which of these is a picture of a cell?

A.



B.

C.

D.

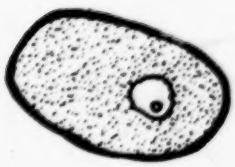
4. Which of these is <u>NOT</u> a cell?

A.

B.

C.

5. This picture shows:



A. a molecule

B. an atom

C. a tissue

D. a cell

6. <u>All</u> cells:

A. are long and narrow

B. are the same size

C. have a membrane around them

D. are round

7. What is <u>NOT</u> true for all cells?

A. They have a membrane around them.

B. They contain cytoplasm.

C. They are long and narrow.

D. They are found in living things.

8. The smallest unit of most living things is called:

A. a tissue

B. an organ

C. a cell

D. an atom

9. A cell is:

   A. The smallest unit of most living things

   B. The smallest unit of a substance that has the characteristics of the substance

   C. a group of tissues working together for a certain purpose

   D. an organ used for breathing

10. A cell is a kind of:

   A. instrument

   B. process

   C. basic unit

   D. opening

11. Which of these is a kind of cell?

   A. environment

   B. blood

   C. molecule

   D. energy

12. What is true for cells and muscles?

   A. Muscles and cells are parts of the central nervous system.

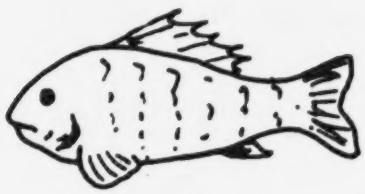
   B. Cells and muscles are the smallest units of living things.

   C. Muscles are made up of a certain kind of cell.

FISH

1. Which picture shows something with fins?

A.



B.

C.

2. The arrow in the picture points to:

A. a fin

B. hair

C. a wing

D. a leg

3. Which picture shows a fish?

A.

B.

C.

4. Which of these is <u>NOT</u> a fish?

A.

B.

5. This is a picture of:

A. a fish

B. an amphibian

C. a mammal

D. a reptile

6. Which of these is true for <u>all</u> fish?

A. They eat other fish for food.

B. They are large.

C. They are gold-colored.

D. They have fins.

7. Which of these is <u>NOT</u> true for all fish?

A. They have fins.

B. They are cold-blooded.

C. They are gold-colored.

D. They live in water.

8. An animal which has fins, lives in water and is cold-blooded is called:

A. an amphibian

B. a fish

C. a reptile

D. a mammal

9. Fish are animals which:

   A. are cold-blooded, have hair and live in water

   B. have fins, are cold-blooded and live in water

   C. have fins, are warm-blooded and live in water

10. <u>All</u> fish are a kind of:

   A. vertebrate

   B. amphibian

   C. mammal

   D. reptile

11. Which of these is a kind of fish?

   A. turtle

   B. frog

   C. perch

   D. wren

12. What is true for fish and gills?

   A. Fish use gills to digest their food.

   B. Fish use gills to keep their balance when swimming.

   C. Fish use gills for breathing.

   D. Fish use gills to find their food.

HEART (Human)

1. If something is "pumping," it:

   A. sends messages

   B. breaks things up into smaller pieces

   C. pushes something from one place to another

   D. attracts things that are made of metal

2. If something pushes things from one place to another, we say it is:

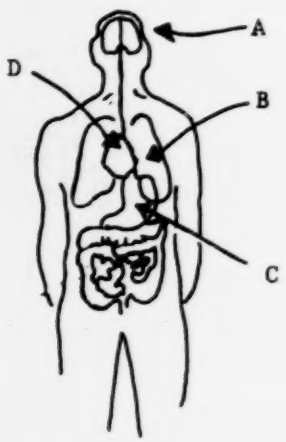
   A. pumping

   B. melting

   C. insulating

   D. burning

3. Which arrow points to the heart?



4. Which of these is <u>NOT</u> a picture of the heart?

A.

B.

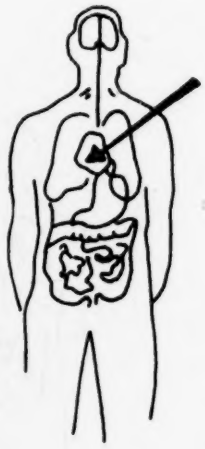
5. The arrow in the picture points to the:

A. stomach

B. heart

C. lungs

D. brain



6. Which of these is <u>always</u> true for the human heart?

A. It is always the same size.

B. It beats at one speed.

C. It is a muscle.

7. Which of these is <u>NOT</u> always true for the human heart?

A. It is a muscle.

B. It has four chambers.

C. It pumps blood.

D. It beats at one speed.

8. The organ which pumps blood throughout the body is called the:

A. heart

B. intestine

C. stomach

D. lungs

9. The human heart is an organ which:

   A. carries messages to the brain

   B. pumps blood throughout the body

   C. exchanges carbon dioxide for oxygen

   D. breaks food down into smaller pieces

10. A heart is a kind of:

   A. vertebrate

   B. process

   C. organ

11. Which of these is a use of the heart?

   A. It moves blood throughout the body.

   B. It controls the digestion of your food.

   C. It manufactures red blood cells.

12. What is true for heart and stomach?

   A. The stomach carries messages from the lungs to the heart.

   B. The heart pumps blood to the stomach.

   C. The heart makes enzymes for the stomach.

   D. The stomach controls the beat of the heart.

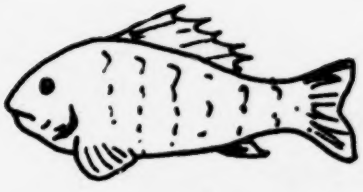
INVERTEBRATE

1. Which of the following has no backbone?

A.

B.

C.



D.

2. This picture shows something:

A. with a backbone

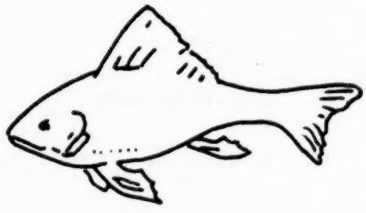
B. without a backbone

1985

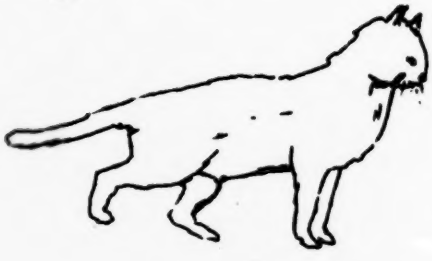
3. Which picture shows an invertebrate?

A.

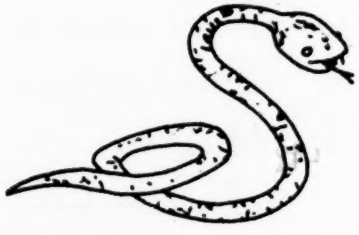
B.



C.



D.



4. Which of these is <u>NOT</u> an invertebrate?

A.

B.

C.

D.

5. This is a picture of:

A. an invertebrate

B. a fish

C. a vertebrate

D. a reptile

6. Which of these is true for <u>all</u> invertebrates?

A. They are without backbones.

B. They live in water.

C. They can fly.

D. They live on land.

7. <u>NOT</u> all invertebrates:

A. are without backbones.

B. are animals.

C. are large in size.

8. An animal without a backbone is called:

A. a fossil

B. an invertebrate

C. a vertebrate

D. an amphibian

9. An invertebrate is:

A. a plant which gets its food from another plant

B. an animal with a backbone

C. a plant which gets its food from the soil

D. an animal without a backbone

10. Invertebrates are kinds of:

A. animals

B. plants

C. minerals

D. vegetables

11. Which of these is a kind of invertebrate?

A. a reptile

B. an amphibian

C. an insect

D. a fish

12. What is true for invertebrates and lungs?

A. Invertebrates use lungs for digestion of food.

B. Most invertebrates that live on land have lungs.

C. The lungs are a sense organ for invertebrates.

D. Most invertebrates do not have lungs.

LENS (Eye)

1. Which picture shows something being bent?

A.

B.

C.

D.

2. The picture shows something which is being:

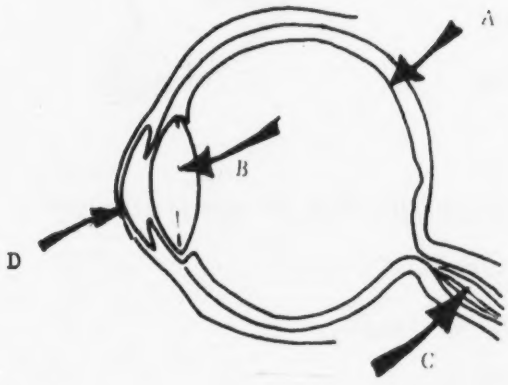
A. cut

B. cracked

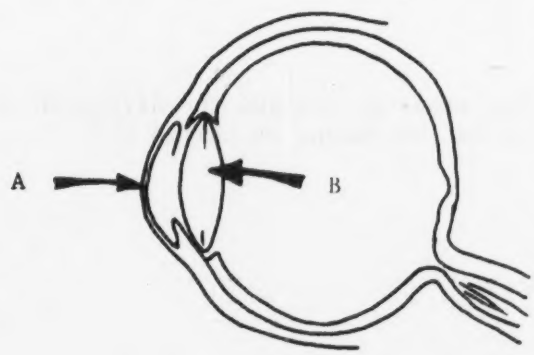
C. bent

D. torn

3. Which arrow points to the lens (of the eye)?



4. Which arrow does <u>NOT</u> point to the lens (of the eye)?



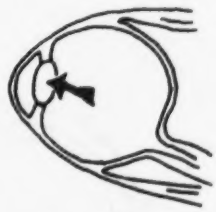
5. The arrow in the picture points to the:

A. cornea (of the eye)

B. retina (of the eye)

C. iris (of the eye)

D. lens (of the eye)



6. What is <u>always</u> true for the lens of the human eye?

A. It has one thickness.

B. It produces a clear image.

C. It focuses light rays.

7. What is <u>NOT</u> always true for the lens of the human eye?

A. It is located near the front of the eye.

B. It has one thickness.

C. It focuses light rays.

D. It has muscles which can change their shape.

8. The eye part that bends or changes the direction of light rays and focuses them on the retina is called the:

A. cornea

B. iris

C. pupil

D. lens

9. The lens is the eye part that:

   A. bends or changes the direction of light rays and focuses them on the retina

   B. is a tough transparent membrane that covers the outer eye

   C. is colored, located near the front of the eye, and controls the amount of light entering the eye

10. The lens is a kind of:

   A. nose part

   B. eye part

   C. ear part

   D. skin part

11. Which of these is a kind of lens?

   A. convex

   B. hinge

   C. skeletal

   D. voluntary

12. What is true for the iris and lens of the eye?

   A. The iris can change the shape of the lens.

   B. The iris controls the amount of light hitting the lens.

   C. The iris is protected by the lens.

   D. The lens focuses light on the iris.

LUNGS

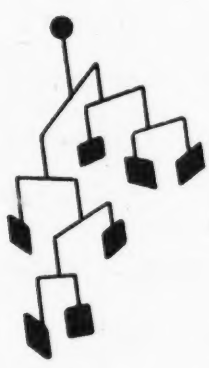
1. Which picture shows something which is "sac-like"?

A.

B.

C.

D.



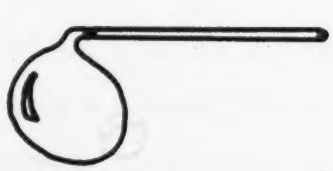
2. The picture shows something which looks like a:

A. coil

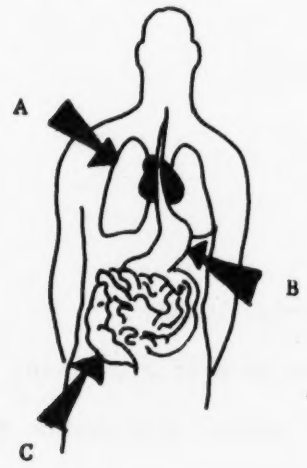
B. sac

C. cube

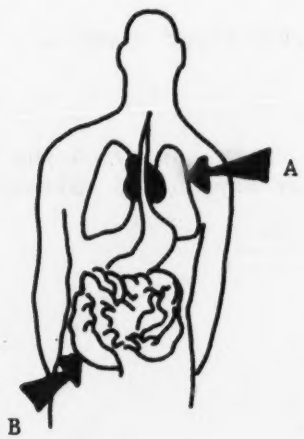
D. fiber



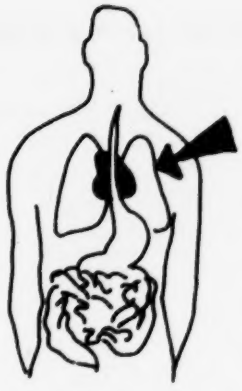
3. Which arrow points to the lung(s)?



4. Which arrow does <u>NOT</u> point to the lung(s)?



5. The arrow in this picture points to the:



A. intestine

B. stomach

C. kidney(s)

D. lung(s)

6. What is <u>always</u> true about lungs?

A. They stay the same size at all times.

B. They contain more oxygen than carbon dioxide.

C. They exchange carbon dioxide and oxygen.

7. Which of these is <u>NOT</u> always true about lungs?

A. They stay the same size at all times.

B. They are used by air-breathing mammals.

C. They are sac-like.

D. They contain many tiny blood vessels.

8. Sac-like organs in the chest cavity of the body where carbon dioxide is exchanged for oxygen are called:

A. lungs

B. intestines

C. tonsils

D. kidneys

9. Lungs are:

A. organs which remove liquid wastes from the blood

B. muscular organs which pump blood throughout the body

C. the organs where digested food passes into the blood stream

D. sac-like organs which exchange carbon dioxide for oxygen

10. Lungs are a kind of:

A. joint

B. organ

C. process

D. sense

11. Lungs are used for:

A. carrying messages to the brain

B. breathing

C. pumping blood from one place to another

D. digestion

12. What is true for lungs and ribs?

A. The ribs are located inside the lungs.

B. The ribs carry oxygen away from the lungs.

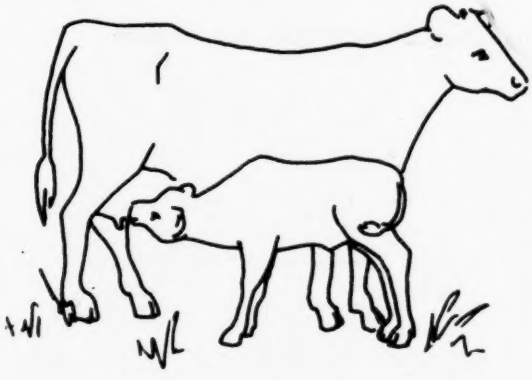
C. The lungs are protected by the ribs.

D. The lungs attach the ribs to the skeleton.

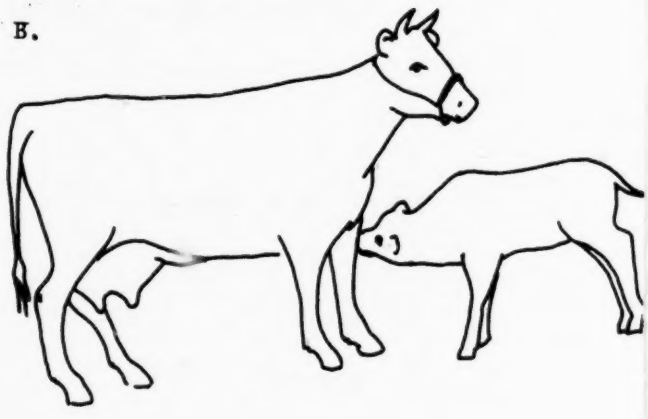
MAMMAL

1. Which picture shows the young feeding on the mother's milk?

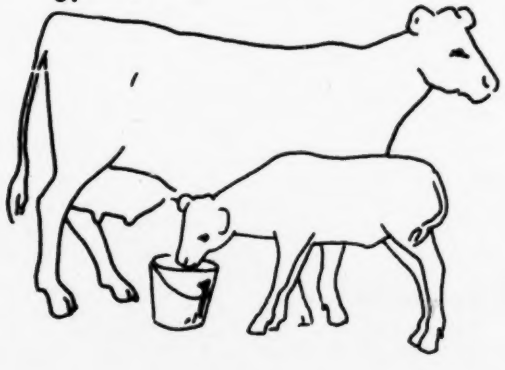
A.



B.



C.

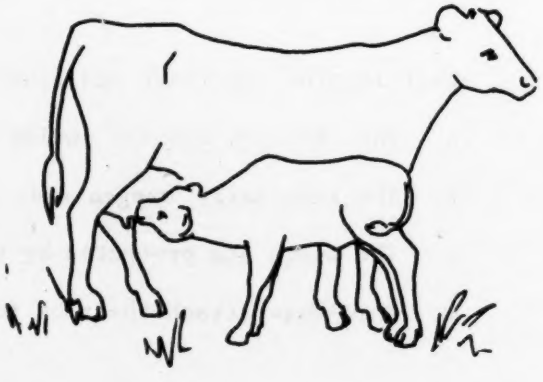


2. This picture shows:

A. the young feeding on the mother's milk

B. The young feeding on grass

C. The young cleaning the mother's hair



3. Which of these is a mammal?

A.

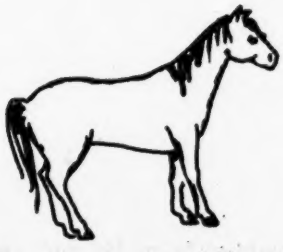
B.

C.

D.

4. Which of these is <u>NOT</u> a mammal?

A.



B.

C.

D.

5. The picture shows:

A. a reptile

B. a mammal

C. a fish

D. an amphibian

6. What is true for <u>all</u> mammals?

A. They live in warm places.

B. They have a spotted coat.

C. They feed their young on the mother's milk.

7. Which is <u>NOT</u> true for all mammals?

A. They feed the young on the mother's milk.

B. They are warm-blooded.

C. They have hair.

D. They are brown in color.

8. An animal which feeds its young on the mother's milk and is warm-blooded is called a:

A. mammal

B. bird

C. reptile

D. fish

9. A mammal is an animal which:

   A. is cold-blooded and lays eggs

   B. is warm-blooded and feeds its young on the mother's milk

   C. is warm-blooded and has feathers

   D. has a body the same temperature as the air around it

10. <u>All</u> mammals are kinds of:

   A. reptiles

   B. plants

   C. vertebrates

   D. fish

11. Which of these is a kind of mammal?

   A. chicken

   B. frog

   C. fish

   D. dog

12. Which is true about mammals and lungs?

   A. Mammals use lungs for picking up sounds.

   B. Lungs are usually found on the mammals' legs.

   C. Mammals use lungs for breathing.

   D. Lungs are the digestive organs of mammals.

MUSCLE

1. Something that contracts and relaxes:

   A. gets longer until it breaks

   B. changes from a solid to a liquid

   C. gets shorter and longer

2. If something gets shorter and longer, we say it:

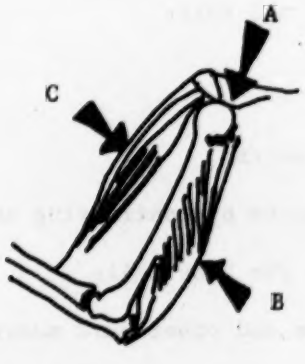
   A. contracts and relaxes

   B. condenses and evaporates

   C. gets longer until it breaks

3. Which arrow in the picture points to a muscle?

4. Which arrow does <u>NOT</u> point to a muscle?



5. The arrow in the picture points to a:

A. bone

B. joint

C. muscle

6. <u>All</u> muscles:

A. can be controlled as you wish

B. can contract and relax

C. are attached to bones

7. What is <u>NOT</u> true for all muscles?

A. They can be controlled as you wish.

B. They are made of bundles of tissue.

C. They cause movement.

D. They can contract and relax.

8. A muscle is an organ which:

A. helps move body parts by contracting and relaxing

B. carries oxygen to the body cells

C. is made of calcium and other hard materials

D. removes sweat and other wastes from the body

9. An organ which helps move body parts by relaxing and contracting is called a:

   A. joint

   B. kidney

   C. nerve

   D. muscle

10. A muscle is a kind of:

   A. organ

   B. vertebrate

   C. process

11. Which of these is a kind of muscle?

   A. voluntary

   B. hinge

   C. inflated

12. What is true for muscle(s) and the heart?

   A. The heart carries messages to the muscles.

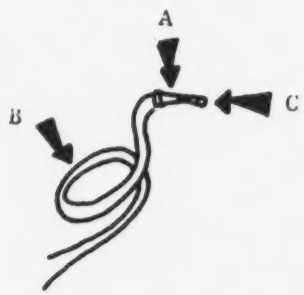
   B. The muscle(s) are controlled by the heart.

   C. The heart is made of a special kind of muscle.

   D. The heart carries wastes away from the muscles.

PORE (Skin)

1. Which arrow points to an opening?

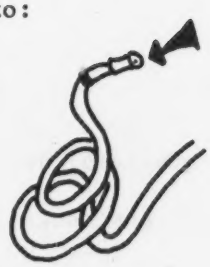


2. The arrow in the picture points to:

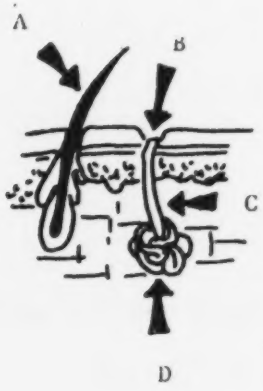
   A. a sack

   B. a tube

   C. an opening



3. Which arrow points to a pore?



4. Which arrow does NOT point to a pore?

5. The arrow in the picture points to a:

A. pore

B. tube

C. hair

D. gland

6. Which of these is <u>always</u> true for pores?

A. Sweat is coming out through them.

B. They are under your arm.

C. They are openings.

7. Which of these is <u>NOT</u> always true for pores?

A. They are connected to glands.

B. They are openings.

C. They have sweat coming out of them.

8. A small opening in the skin through which sweat, wastes, and other substances come out is called a:

A. muscle

B. nose

C. pore

D. joint

9. A pore is:

   A. a bundle of cells which connect muscles to bones

   B. a small opening in the skin through which sweat, wastes, and other substances come out

   C. A group of cells which carry messages from the skin to the brain and back again to the skin

   D. a small spot on the skin which is darker than the rest of the skin

10. A pore is a kind of:

   A. nerve

   B. hair

   C. opening

   D. process

11. Pores are used for:

   A. carrying oxygen to the body cells

   B. attaching muscles to bones

   C. carrying messages from the foot to the brain

   D. removing sweat and other wastes from the body

12. What is true for pores and human beings?

   A. Human beings eliminate wastes through pores.

   B. Pores are used by human beings for breathing.

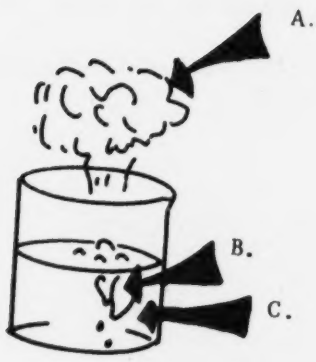
   C. Pores control digestion in human beings.

   D. Human beings use pores for hearing.

Earth Science

CLOUD

1. Which arrow points to a visible mass of water droplets in the air?



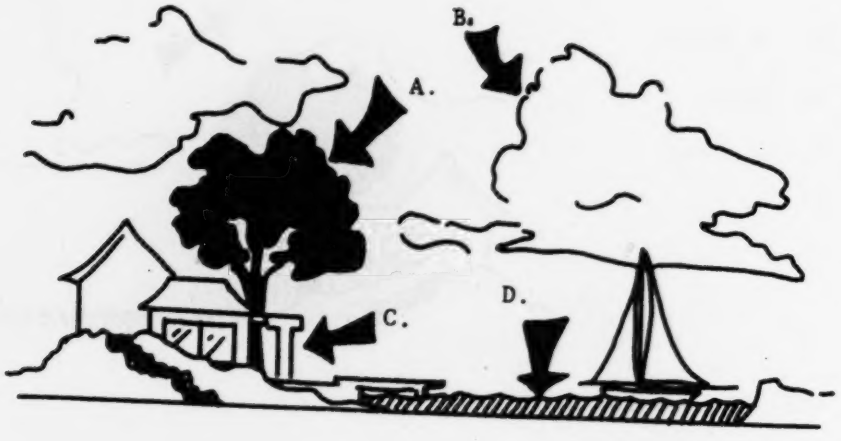
2. The arrow in this picture points to:

   A. invisible water vapor in the air

   B. visible water droplets in the air

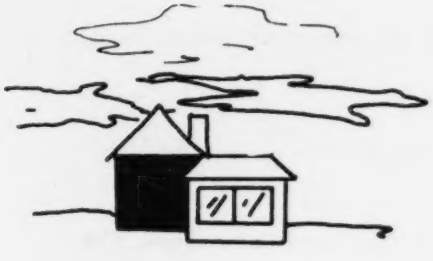
   C. air bubbles rising in a liquid

3. Which arrow points to a cloud?



4. Which picture does NOT show a cloud?

A.



B.

5. The arrow in the picture points to:

A. a star

B. a comet

C. rain

D. a cloud

6. What is true for <u>all</u> clouds?

A. They are thick and puffy.

B. They appear dark in color.

C. They contain tiny droplets of water or ice crystals.

D. They are high above the earth's surface.

7. Which of these is <u>NOT</u> always true about clouds?

A. They are thick and puffy.

B. They are made of tiny droplets of water or ice crystals.

C. They are visible.

D. They are above the earth's surface.

8. A visible mass of water droplets or ice crystals above the earth's surface is called a:

A. cloud

B. meteor

C. glacier

D. hurricane

9. Clouds are:

   A. streaks of light flashing across the sky

   B. large masses of packed snow moving slowly down the slope of a mountain

   C. visible masses of water droplets or ice crystals above the earth's surface

   D. strong winds that develop over warm oceans and cause large waves

10. A cloud is a kind (form) of:

   A. rock

   B. wind

   C. glacier

   D. water

11. Which of these is a kind of cloud?

   A. continental

   B. cumulus

   C. gale

12. What is true for clouds and atmosphere?

   A. Clouds are found in the earth's atmosphere.

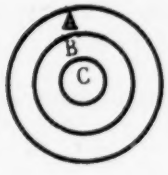
   B. Clouds divide the atmosphere into layers.

   C. The mantle is the part of the earth's atmosphere that contains clouds.

   D. Clouds cause winds to form in the atmosphere.

CORE (Earth)

1. Which letter is on the <u>center</u>?



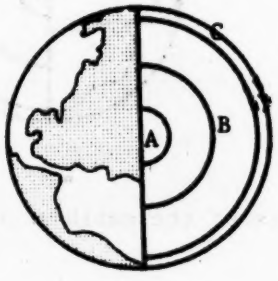
2. The letter C is:

   A. on the center

   B. between the center and the outside

   C. on the outside

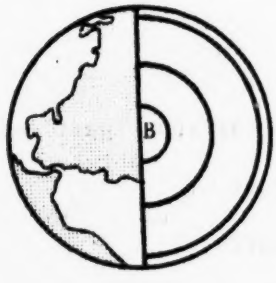
3. Which letter is on the core (of the earth)?



4. Which letter is <u>NOT</u> on the core (of the earth)?

A.

B.



5. The letter A is on the:

A. crust (of the earth)

B. core (of the earth)

C. mantle (of the earth)

6. It is believed that <u>all</u> parts of the earth's core are:

A. hot

B. liquid

C. solid

7. It is believed that <u>NOT</u> all parts of the earth's core are:

A. solid

B. hot

C. under pressure

8. The center zone (part) of the earth is called the:

A. crust

B. mantle

C. core

9. The core of the earth is:

   A. the center zone (part)

   B. the outer zone (part)

   C. the middle zone--the part between the center and the outer zone

10. The core (of the earth) is a kind of:

   A. surface

   B. atmosphere

   C. zone

   D. force

11. Which of these is a kind of core (of the earth)?

   A. inner core

   B. negative core

   C. voluntary core

   D. sedimentary core

12. What is true for core (of the earth) and temperature?

   A. The core controls the temperature of the oceans.

   B. The core has a very high temperature.

   C. The temperature of the core decreases at night.

FOSSIL

1. Which arrow points to a clue?

2. The arrow points to:

   A. energy

   B. a crater

   C. a clue

   D. a force

3. Which picture shows a fossil?

A.

B.

4. Which of these pictures does NOT show a fossil?

A.

B.

5. This is a picture of:

A. a fossil

B. a crater

C. a plant

D. an animal

6. <u>All</u> fossils:

A. are remains of animals that once lived in water

B. are remains or imprints of plants

C. are clues about animals which lived in the forest

D. are clues about plants and animals which were once alive

7. What is <u>NOT</u> true for all fossils?

A. They give us information about the past.

B. They are remains or imprints of plants.

C. They are clues about living things.

8. Any imprint or remains that is a clue (evidence) about plants and animals that lived long ago is called a:

A. glacier

B. fossil

C. crater

D. vertebrate

9. A fossil is:

   A. any imprint or remains that is a clue (evidence) about plants and animals that lived long ago

   B. a plant or animal that lives in the Arctic

   C. a time when giant ferns grew in many places on the earth

   D. a special kind of plant or animal that lives in the forest

10. Fossils are kinds of:

   A. bodies that reflect light from the sun

   B. plants that live in the desert

   C. clues about ancient plants and animals

   D. clams that live in the ocean

11. Which of these are kinds of fossils?

   A. imprints and remains

   B. major and minor

   C. desert and ocean

12. What is true for fossils and plants?

   A. Fossils are plants that are over 100 years old.

   B. Plants get their food from fossils.

   C. Fossils can be formed from plants.

   D. Fossils are plants that grow in water.

GLACIER

1. Which of these forms when great amounts of snow pile up on top of each other?

   A. ice

   B. dunes

   C. fog

   D. rain

2. Ice forms when:

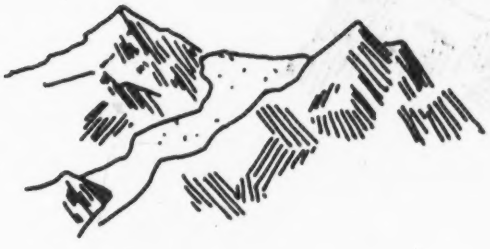
   A. large amounts of snow pile up on top of each other

   B. warm and cold water meet in the ocean

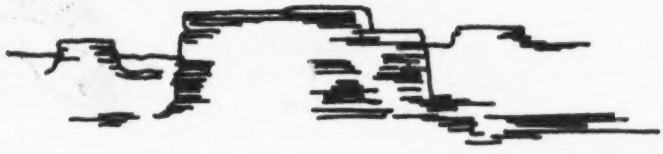
   C. a cold air mass meets a warm air mass

3. Which picture shows a glacier?

A.



B.



C.

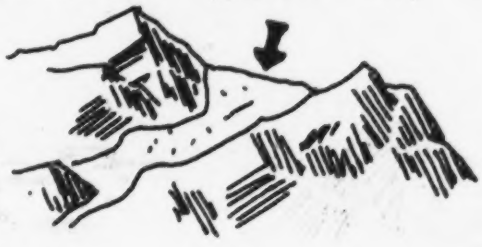
D.

4. Which of these pictures does NOT show a glacier?

A.

B.

5. The arrow in this picture points to a:



A. lake

B. geyser

C. volcano

D. glacier

6. Which of these is true for <u>all</u> glaciers?

A. They are made of packed ice and snow.

B. They occur in valleys.

C. They are located near the equator.

D. They are found in northern areas.

7. What is <u>NOT</u> true for all glaciers?

A. They move slowly.

B. They are made of ice and snow.

C. They are located in northern areas.

8. A huge mass of packed ice and snow that moves slowly over the surface of the earth is called a:

A. river

B. mastodon

C. tornado

D. glacier

9. A glacier is:

   A. a huge sheet of ice and snow that moves slowly over the earth's surface

   B. an ocean with underwater mountains and rivers

   C. an animal that lived in ancient times in northern climates

10. A glacier is a kind of:

   A. mountain valley

   B. ocean shelf

   C. force (of erosion)

   D. heavenly body

11. Which of these are ways of grouping glaciers?

   A. longitude and latitude

   B. igneous and sedimentary

   C. valley and mountain

12. What is true for glaciers and valleys?

   A. A valley can be caused by a glacier.

   B. A glacier is formed when ice in a valley melts.

   C. A valley is necessary for a glacier to occur.

   D. The cracks in the surface of a glacier are called valleys.

METEOR

1. Which of these tells about a glowing body?

   A. It gives off light.

   B. It reflects light.

   C. It makes loud noises.

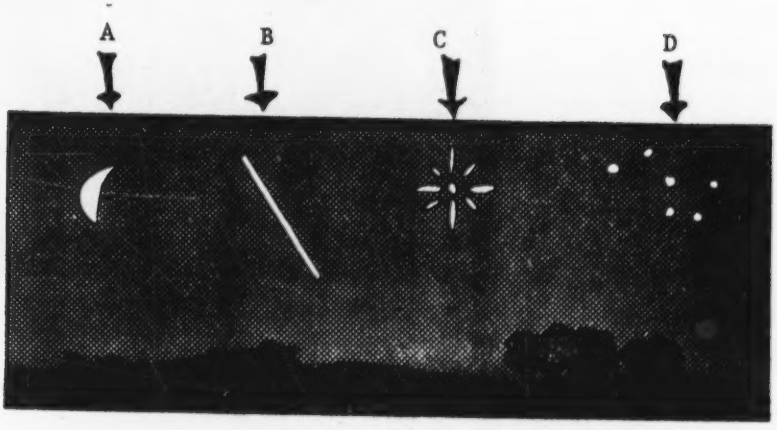
2. Something which gives off light is said to be:

   A. glowing

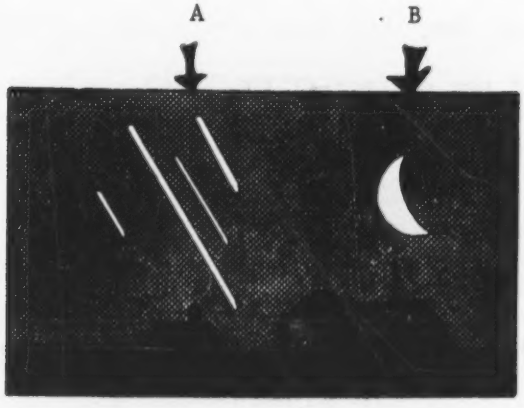
   B. condensing

   C. bubbling

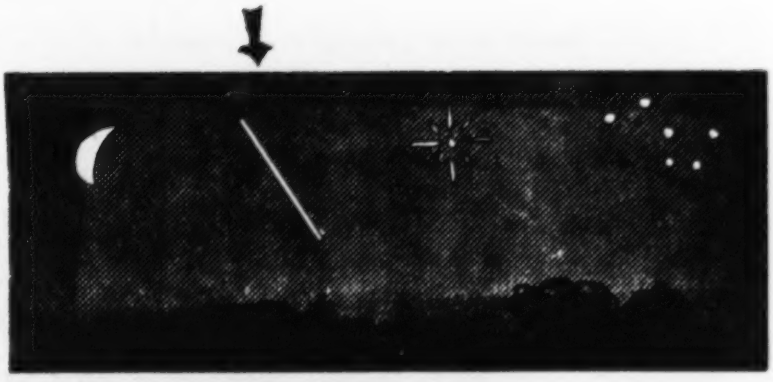
3. Which arrow points to a meteor?



4. Which arrow does NOT point to a meteor?



5. The arrow points to a:



A. meteor

B. planet

C. star

D. constellation

6. All meteors:

A. explode when they come close to the Earth

B. hit the surface of the Earth

C. are made of the same material

D. glow when they enter the Earth's atmosphere

7. Which is NOT true for all meteors?

A. They glow when they enter the Earth's atmosphere.

B. They hit the surface of the Earth.

C. They travel at high speed.

8. A piece of rock or metal which travels through space and gets hot and glows as it enters the earth's atmosphere is called a:

A. meteor

B. star

C. mineral

D. satellite

9. A meteor is:

   A. a piece of rock or metal which travels through space and gets hot and glows as it enters the Earth's atmosphere

   B. a minor planet which is located between the orbits of Mars and Jupiter

   C. a body whose shadow causes an eclipse of the sun

   D. an object which has a burning tail which points away from the sun

10. A meteor is kind of:

   A. moon

   B. meteoroid

   C. constellation

   D. star

11. Which of these are ways of grouping meteors?

   A. volcanic and sedimentary

   B. inner and outer

   C. metal and stone

12. What is true for meteors and craters?

   A. The path a meteor follows is a crater.

   B. Meteors can cause craters when they land on the earth.

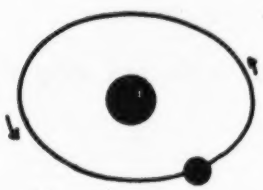
   C. The hottest meteors form the biggest craters.

   D. Craters are meteors that burn out before they hit the earth.

MOON

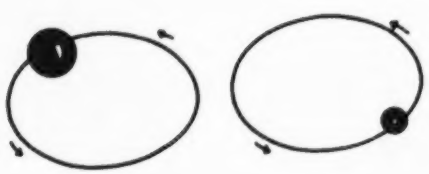
1. Which of these shows a smaller body revolving around a larger body?

A.



B.

C.



2. This picture shows:

A. a small body spinning on its axis

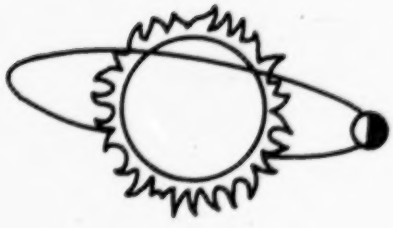
B. a large body and a small body in separate orbits

C. a smaller body revolving around a larger body

3. Which picture shows a moon?

A.

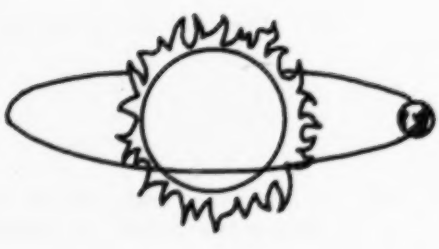
B.



4. Which of these pictures does <u>NOT</u> show a moon?

A.

B.



5. This picture shows the earth and a:

A. meteor

B. moon

C. star

D. planet

6. <u>All</u> moons:

A. revolve around a planet

B. revolve around the Earth

C. give off heat

7. Which of these is <u>NOT</u> true for all moons?

A. They revolve around the Earth.

B. They revolve around a planet.

C. They are smaller than the body they revolve around.

D. They shine by reflected light.

8. A heavenly body which revolves around a planet and shines by reflected light is called a:

A. moon

B. meteor

C. sun

D. star

9. A moon is a heavenly body which:

   A. revolves around the sun and has a glowing tail

   B. revolves around a planet and shines by reflected light

   C. is hot and gives off its own light

   D. revolves around the Earth and has a glowing tail

10. A moon is a kind of:

   A. constellation

   B. heavenly body

   C. comet

   D. star

11. Which of these is a way of grouping moons?

   A. natural and artificial

   B. negative and positive

   C. valley and mountain

12. What is true for moon and sun?

   A. The moon can cause an eclipse of the sun.

   B. The moon is bigger than the sun.

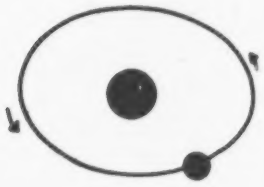
   C. The moon's gravity causes spots on the sun.

   D. The sun can pass between the earth and the moon.

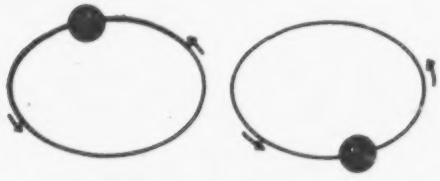
PLANET

1. Which of these shows one body revolving around another body?

A.



B.



C.

D.

2. This picture shows:

A. two bodies in separate orbits

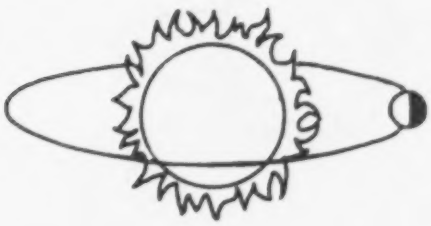
B. one body revolving around another body

C. two bodies following the same path (in the same orbit)

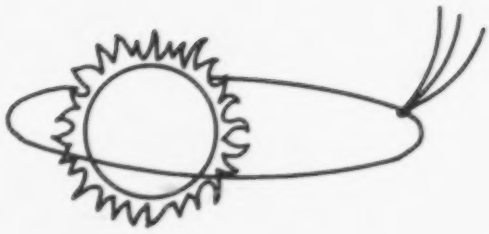
D. a body spinning on its axis

3. Which picture shows a planet?

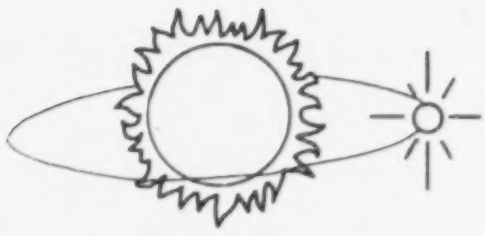
A.



B.

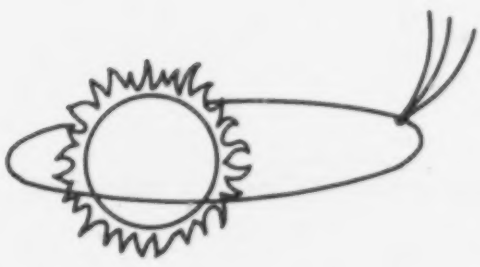


C.

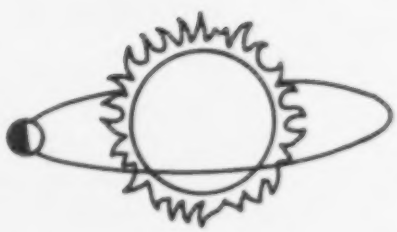


4. Which of these does <u>NOT</u> show a planet?

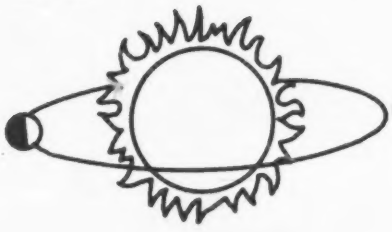
A.



B.



5. This picture shows the sun and a:



A. meteor

B. comet

C. star

D. planet

6. Which of these is true for <u>all</u> planets?

A. They are all the same size.

B. They can be seen from the earth with the naked eye.

C. They reflect light.

D. They have a very hot temperature.

7. Which is <u>NOT</u> true for all planets?

A. They reflect light from the sun.

B. They can be seen from the earth with the naked eye.

C. They revolve around the sun.

D. They are a kind of heavenly body.

8. A body in the sky which revolves around the sun and shines by reflected light is called:

A. a planet

B. a star

C. a meteor

D. an artificial satellite

9. A planet is a heavenly body which:

   A. revolves around the sun and has a glowing tail

   B. revolves around the earth

   C. revolves around the sun and shines by reflected light

   D. gives off its own light

10. A planet is a kind of:

   A. star

   B. meteor

   C. heavenly body

   D. moon

11. Which of these are ways of grouping planets?

   A. mountain or crater

   B. major or minor

   C. igneous or sedimentary

   D. giant or dwarf

12. What is true for planets and orbits?

   A. Planets have several orbits.

   B. The distance of a planet from the sun is measured in orbits.

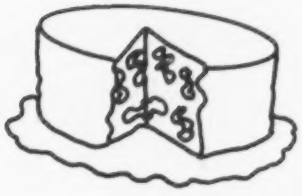
   C. Planets travel in paths called orbits.

   D. All planets have orbits of the same size.

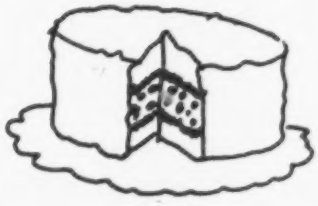
SEDIMENTARY ROCK

1. Which picture shows something formed in layers?

A.



B.

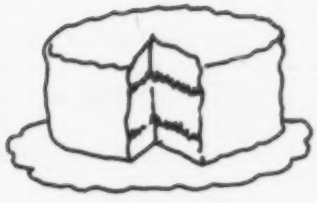


2. This picture shows something which is:

A. alike all over

B. formed in layers

C. in a mixed up order

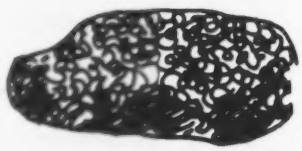


87

3. Which picture shows a sedimentary rock?

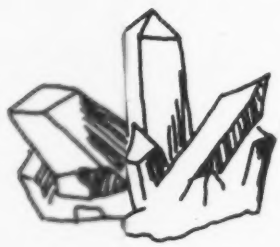
A.

B.



C.

D.



4. Which of these is NOT a sedimentary rock?

A.

B.

5. This is a picture of:

A. a volcanic rock

B. a metamorphic rock

C. an igneous rock

D. a sedimentary rock

6. Which is true for <u>all</u> sedimentary rocks?

A. They break into smaller pieces easily.

B. They are formed in layers.

C. They are gray in color.

D. They are shiny on the surface.

7. Which of these is <u>NOT</u> true for all sedimentary rocks?

A. They are formed in layers.

B. They will break into smaller pieces easily.

C. They are formed from sand, soil, and other materials.

8. A rock formed in layers from sand, soil, and pieces of other materials is called:

A. a volcanic rock

B. a metamorphic rock

C. a sedimentary rock

D. an igneous rock

9. Sedimentary rocks are:

   A. formed in layers from pieces of sand, soil, and other materials

   B. formed from cooled lava from the earth's core

   C. formed from other rocks due to great pressures

10. Sedimentary is a kind of:

   A. oil

   B. rock

   C. gas

   D. wood

11. Which of these is a kind of sedimentary rock?

   A. marble

   B. granite

   C. slate

   D. limestone

12. Which is true about sedimentary rock and fossils?

   A. Heat and pressure change sedimentary rocks into fossils.

   B. Sedimentary rock and fossils are usually found near volcanoes.

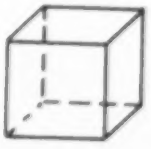
   C. Fossils are usually found in sedimentary rock.

VOLCANO

1. Which picture shows something which is cone-shaped?

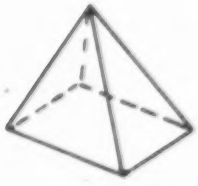
A.

B.



C.

D.



2. This picture shows something which is:

A. pyramid-shaped

B. cube-shaped

C. cone-shaped

D. ball-shaped

3. Which picture shows a volcano?

A.

B.

C.

4. Which of these does <u>NOT</u> show a volcano?

A.

B.

5. This shows a picture of a:

A. hill

B. volcano

C. plain

D. plateau

6. What is true about <u>all</u> volcanoes?

A. They are active.

B. They are covered with snow.

C. They are reddish-brown in color.

D. They are formed from molten rock.

7. Which of these is <u>NOT</u> true about all volcanoes?

A. They are formed from molten rock.

B. They are covered with snow.

C. They form a mound on the earth's surface.

8. A cone-shaped mountain, formed by molten rock pushing up through a hole in the earth's crust is called a:

A. volcano

B. plateau

C. butte

9. Volcanoes are mountains which are formed by:

   A. blocks of the earth's crust being pushed up

   B. molten rock pushing up through a hole in the earth's crust

   C. washing away of the material around it

   D. the folding of the earth's crust

10. Volcanoes are a kind of:

   A. plateau

   B. valley

   C. mountain

   D. plain

11. Which of these are ways of grouping volcanoes?

   A. active or passive

   B. valley or continental

   C. hot or cold

12. What is true for volcanoes and igneous rocks?

   A. Erosion can change igneous rocks into volcanoes.

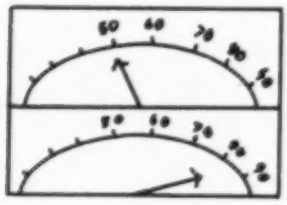
   B. Volcanoes are formed when heat and pressure change soil.

   C. Igneous rocks are made of lava from volcanoes.

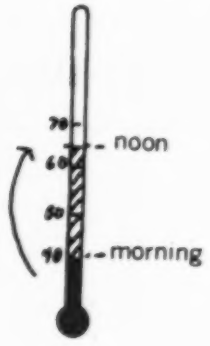
WIND

1. Which arrow or set of arrows shows something moving from high to low?

A.

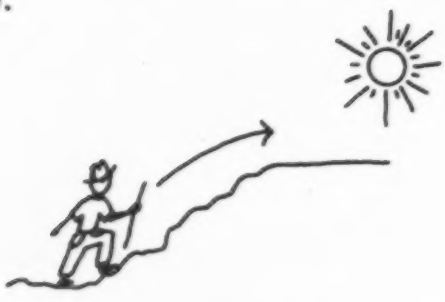


B.



C.

D.



2. This picture shows:

A. something moving from low to high

B. something moving from high to low

C. something which is not moving

3. Which picture shows a wind?

A.

B.

C.

D.

4. Which of these would NOT show a wind?

A.

B.

5. Which of these is shown in the picture?

A. cloud

B. mountain

C. wind

D. glacier

6. What is <u>always</u> true for wind?

A. It is moving air.

B. It is warm air.

C. It blows hard.

D. It blows from west to east.

7. Which of these is <u>NOT</u> always true for wind?

A. It is air which moves very fast.

B. It is air moving due to differences in air pressure.

C. It is moving air.

D. It is air moving anywhere on the surface of the earth.

8. Air moving due to differences in air pressure is called:

A. temperature

B. wind

C. atmosphere

D. gravity

9. Wind is:

   A. moving of the earth's surface caused by slipping of rock under the ground

   B. ice moving slowly down a slope

   C. air moving due to differences in air pressure

   D. air causing lava to push up through a hole in the earth's crust

10. Wind is a kind of:

   A. cloud

   B. instrument

   C. direction

   D. force

11. Which of these is a kind of wind?

   A. hurricane

   B. storm

   C. rain

12. What is true for wind and clouds?

   A. Clouds are moved by wind.

   B. Wind causes the dark color in clouds.

   C. The direction the wind blows is controlled by clouds.

   D. Wind will not blow unless clouds are high in the sky.

CONDUCTOR

1. When something "flows" it:

   A. does not move

   B. moves from one place to another

   C. changes from a liquid to a solid

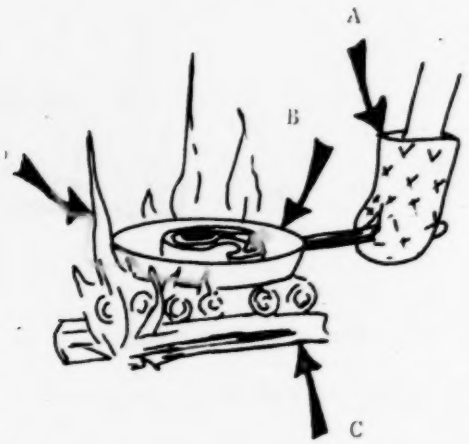
2. If something moves from one place to another, we say it:

   A. evaporates

   B. condenses

   C. flows

3. Which arrow points to a conductor?



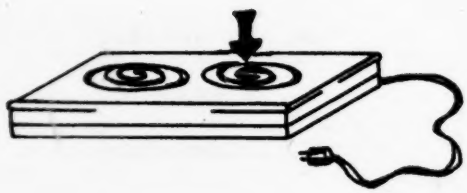
4. Which of these is <u>NOT</u> a conductor?

A.

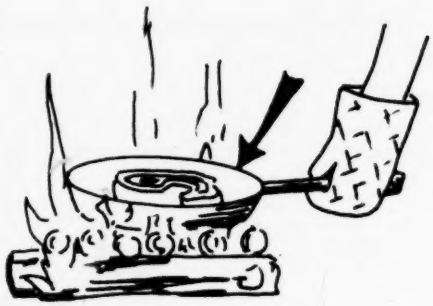
B.

C.

D.



5. The arrow in the picture points to:



A. an insulator

B. a thermometer

C. a conductor

D. an electromagnet

6. Which of these is true for <u>all</u> conductors?

A. They are solid forms of matter.

B. Energy flows through them.

C. Sound flows through them.

7. Which of these is <u>NOT</u> true for all conductors?

A. They are solids.

B. Energy flows through them.

C. They are a kind of matter.

8. A substance which allows energy to flow through it is called:

A. an insulator

B. a barometer

C. a conductor

9. A conductor is:

   A. a substance which lets energy flow through it

   B. an instrument for measuring the air pressure

   C. a force caused by strong magnets

   D. a simple machine that makes work easier

10. A conductor is a kind of:

   A. gravity

   B. process

   C. matter

   D. friction

11. Which of these is a kind of conductor?

   A. wood

   B. glass

   C. plastic

   D. metal

12. What is true for thermometers and conductors?

   A. A conductor is needed to make a thermometer.

   B. The marks (units) on a thermometer are called conductors.

   C. Electricity is needed to make conductors and thermometers work.

EVAPORATION

1. Which of these shows particles leaving the surface of a liquid?

A.

B.

C.

D.

2. This picture shows:

A. a solid changing to a liquid

B. a liquid changing to a solid

C. particles escaping from the surface of a liquid

3. Which of these best shows evaporation?

A.

B.

C.

4. Which of these does <u>NOT</u> show evaporation.

A.

B.

C.

5. This picture shows:

A. burning

B. melting

C. condensation

D. evaporation

6. What is <u>always</u> true about evaporation?

A. Particles are escaping from the surface of a liquid.

B. Particles escape slowly from the surface of a liquid.

C. Particles escape rapidly from the surface of a liquid.

7. Which of these is <u>NOT</u> always true for evaporation?

A. A change of phase (form) occurs.

B. It happens rapidly.

C. It requires energy.

D. Molecules are in motion.

8. The process by which a liquid changes to a gas as particles escape from the surface of the liquid is called:

A. burning

B. condensation

C. evaporation

D. melting

9. Evaporation is a process by which:

   A. a substance changes in volume because its particles move farther apart

   B. a solid changes to a liquid because of increased motion of the particles

   C. a liquid changes to a gas as particles escape from the surface of the liquid

10. Evaporation is a kind of:

   A. organism

   B. structure

   C. process

   D. mineral

11. Which of these are kinds of evaporation?

   A. slow and rapid

   B. inner and outer

   C. dwarf and giant

   D. negative and positive

12. What is true about evaporation and cooling?

   A. Cooling is necessary for evaporation to take place.

   B. Cooling speeds up evaporation.

   C. Evaporation can cause cooling.

EXPANSION

1. Which of these describes an increase in volume of a substance?

   A. It gets bigger in size.

   B. The particles are escaping from a surface.

   C. It changes to a new material.

   D. It takes up less room.

2. If something gets bigger in size it is:

   A. changing from a solid to a liquid

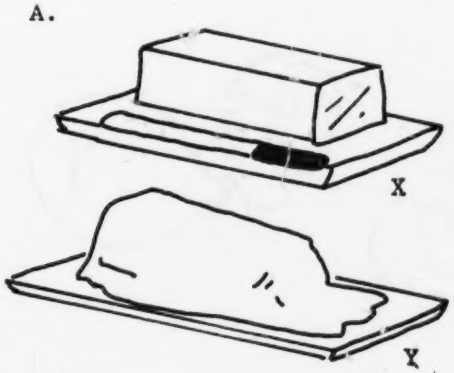
   B. increasing in volume

   C. changing to a new material

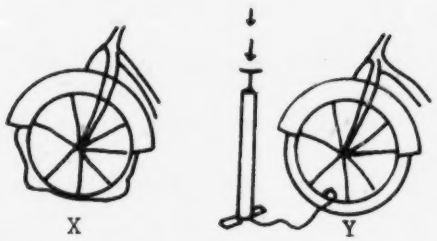
   D. breaking up into smaller pieces

3. Which pair of pictures shows expansion from X to Y?

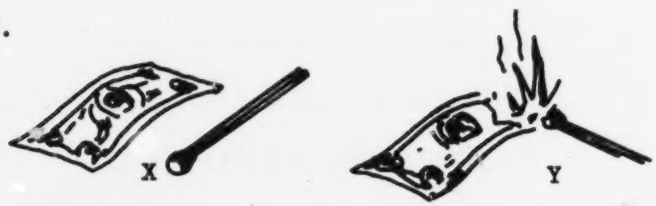
A.



B.



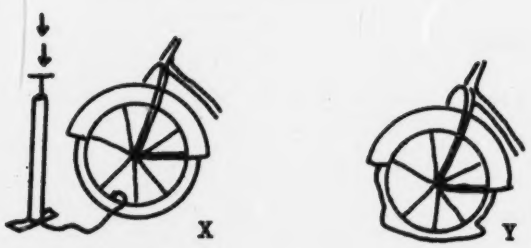
C.



4. Which pair of pictures does NOT show expansion from X to Y?

A.

B.



5. These pictures from X to Y show:

A. condensation

B. expansion

C. melting

D. evaporation

6. Which of these is <u>always</u> true for expansion.

A. The volume increases.

B. The substance breaks its container.

C. The volume doubles.

7. Which of these is <u>NOT</u> always true for expansion?

A. The volume increases rapidly.

B. Particles are in motion.

C. It involves energy.

8. The process by which a substance increases in volume is called:

A. evaporation

B. contraction

C. burning

D. expansion

9. Expansion is the process by which:

   A. a solid changes to a liquid

   B. a liquid changes to gas

   C. a substance increases in volume

10. Expansion is a kind of:

   A. burning

   B. energy

   C. process

   D. matter

11. Which of these is a kind of expansion?

   A. hinge

   B. linear (length)

   C. rolling

12. What is true for matter and expansion?

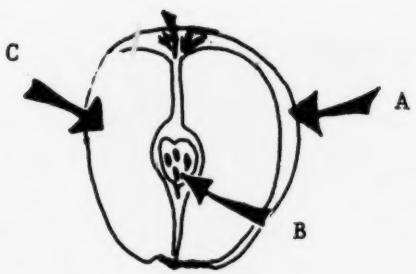
   A. Oxygen is necessary for expansion of matter to occur.

   B. Expansion of matter occurs when it is heated.

   C. New materials are formed during the expansion of matter.

FRICTION

1. Which arrow points to the outer <u>surface</u> of the apple?



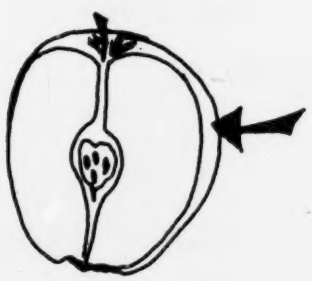
2. The arrow points to the:

   A. center

   B. inner layer

   C. surface

   D. axis

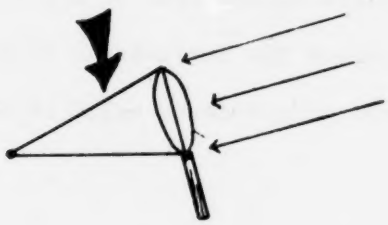


3. In which picture does the arrow point to a place where there is friction between two materials?

A.

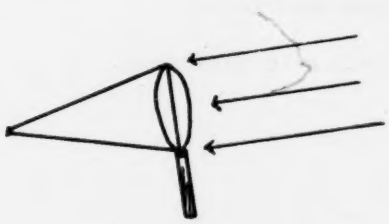
B.

C.



4. In which picture would friction NOT occur?

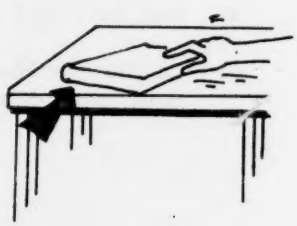
A.



B.

C.

D.

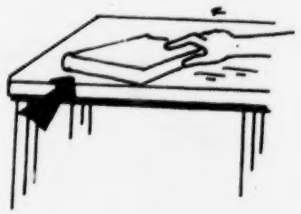


5. Which of these would happen where the arrow points?

A. contraction

B. evaporation

C. friction



6. Which is <u>always</u> true for friction?

A. It produces enough heat to start burning.

B. It occurs at the surfaces of objects or materials.

C. It occurs only between solid objects or materials.

7. Which of these is <u>NOT</u> always true for friction?

A. The materials or objects get warmer.

B. The objects or materials involved are solid.

C. It occurs at the surface of objects or materials.

8. Friction is a force:

A. which causes all bodies to be pulled toward the center of the earth

B. due to light passing through a window pane

C. at the surface of objects or materials which makes it hard to move them across or through each other

9. The force at the surface of objects or materials which makes it hard to move them across or through each other is called:

   A. gravity

   B. friction

   C. work

   D. erosion

10. Friction is a kind of:

   A. weight

   B. matter

   C. work

   D. force

11. Which of these is a kind of friction?

   A. sliding

   B. mountain

   C. reflection

12. What is true about friction and burning?

   A. Oxygen is necessary for friction to cause burning.

   B. Friction and burning are due to differences in pressure.

   C. New materials are made when friction and burning occur.

LIQUID

1. Which of these will take the shape of its container?

A.

B.

C.

D.

2. The arrow in the picture points to something which:

A. will take the shape of its container

B. will keep its shape when put in a container

C. will change its volume when put in a container

3. Which arrow points to a liquid?

4. Which arrow does <u>NOT</u> point to a liquid?

A.

B.

5. The arrow in this picture points to a:

A. liquid

B. gas

C. solid

6. <u>All</u> liquids:

A. are oily

B. have a sweet smell

C. take the shape of their container

D. are clear or colorless

7. Which of these is <u>NOT</u> true for all liquids?

A. They take the shape of their container.

B. They can be poured from one container to another.

C. They have a definite volume.

D. They are clear or colorless.

8. Matter which has a definite volume and takes the shape of its container is called a:

A. gas

B. liquid

C. solid

9. A liquid is matter which:

   A. has a definite volume and takes the shape of its container

   B. has a definite volume and keeps its same shape when put in a container

   C. does not have a definite volume and keeps its same shape when put in a container

10. A liquid is a kind (form) of:

   A. gravity

   B. matter

   C. friction

   D. energy

11. Which of these is a kind of liquid?

   A. air

   B. wood

   C. water

12. What is true about liquids and evaporation?

   A. When a gas changes to a liquid it is called evaporation.

   B. When a solid changes to a liquid it is called evaporation.

   C. When a liquid changes to a gas it is called evaporation.

MELTING

1. Which of these shows something changing from a solid to a liquid?

A.

B.

C.

2. This picture shows a:

A. gas changing to a liquid

B. solid changing to a liquid

C. liquid changing to a gas

D. gas changing to a solid

3. Which of these pictures shows something which is melting?

A.

B.

C.

4. Which of these pictures does <u>NOT</u> show melting?

A.

B.

5. This picture shows something which is:

A. melting

B. dissolving

C. evaporating

D. contracting

6. Which of these is <u>always</u> true about melting?

A. It happens at high temperatures.

B. It happens slowly.

C. A change in phase (form) occurs.

D. The sun must be shining.

7. Which of these is <u>NOT</u> always true for melting?

A. It happens rapidly.

B. A change in phase (form) takes place.

C. Molecules are in motion.

D. Energy is needed.

8. The process by which a solid changes to a liquid is called:

A. evaporation

B. condensation

C. freezing

D. melting

9. Melting is a process by which:

   A. a liquid changes to a solid

   B. a solid changes to a liquid

   C. a liquid changes to a gas

   D. a gas changes to a liquid

10. Melting is a kind of:

   A. mineral

   B. organism

   C. structure

   D. process

11. Which of these are kinds of melting?

   A. inner and outer

   B. slow and rapid

   C. dwarf and giant

   D. negative and positive

12. What is true for melting and matter?

   A. Matter changes from one form to another in melting.

   B. During melting, matter is losing energy.

   C. During melting, matter changes into a new material.

   D. Matter changes into a gas during melting.

MOLECULE

1. If something stays in motion:

   A. it never stops moving

   B. it moves part of the time

   C. it moves when it is pushed

2. Something which never stops moving:

   A. is in motion part of the time

   B. stays in motion

   C. moves only when it is pushed

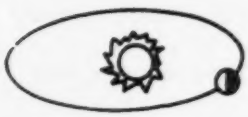
3. Which of these is a picture (diagram) of a molecule?

A.

B.

C.

D.

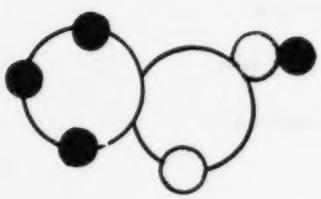


4. Which of these is <u>NOT</u> a picture (diagram) of a molecule?

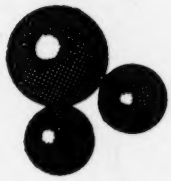
A.

B.

C.



5. This is a picture of a:



A. cell

B. molecule

C. mixture

6. What is <u>always</u> true about molecules?

A. They have a sour taste.

B. They have a sweet smell.

C. They always are in motion.

D. They are colored.

7. What is <u>NOT</u> always true about molecules?

A. They have a sour taste.

B. They are always in motion.

C. All molecules of a substance have the same properties.

D. They are too small to be seen with the naked eye.

8. The smallest particle into which a substance (matter) can be divided and still keep all the properties of that substance is called:

A. a mixture

B. an electron

C. a molecule

9. A molecule is:

   A. the name given to one kind of atom

   B. the smallest particle into which a substance can be divided and still keep all the properties of a substance

   C. a group of substances that keep their own characteristics when mixed together and can be separated from each other again

10. Molecules are a kind of:

   A. matter

   B. energy

   C. magnetism

   D. gravity

11. Which of these is a kind of molecule?

   A. voluntary

   B. large

   C. reflected

12. What is true for molecules and solids?

   A. Molecules in solids do not move.

   B. Molecules in solids change shape.

   C. Molecules in solids are very close together.

SOLID

1. Which of these will keep the same (definite) shape when you put it in a pail?

A.

B.

C.

D.

2. This picture shows something which has:

A. no definite shape

B. a definite shape

C. no definite volume

3. Which arrow points to a solid?

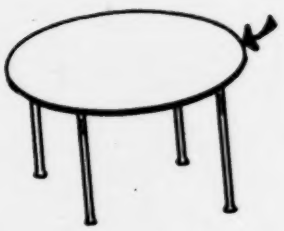
A.

B.

C.

4. Which arrow does <u>NOT</u> point to a solid?

A.



B.

C.

5. This is a picture of a:

A. solid

B. liquid

C. gas

6. Which of these is true for <u>all</u> solids?

A. They are smooth.

B. They have a definite shape.

C. They are large.

D. They are round.

7. Which of these is <u>NOT</u> true for all solids?

A. They have a definite volume.

B. They are made of wood.

C. They have a definite shape.

8. Matter which has both a definite shape and a definite volume is called a:

A. gas

B. solid

C. liquid

9. A solid is a form of matter which has:

   A. a definite shape and a definite volume

   B. a definite shape but no definite volume

   C. no definite volume and no definite shape

   D. a definite volume but no definite shape

10. <u>All</u> solids are forms of:

   A. friction

   B. gravity

   C. energy

   D. matter

11. Which of these is a kind of solid?

   A. milk

   B. water

   C. rock

   D. oxygen

12. What is true about solids and melting?

   A. When a gas changes to a solid it is called melting.

   B. When a solid changes to a liquid it is called melting.

   C. When a solid changes to a gas it is called melting.

SOUND

1. Which of these causes a vibration?

   A. the image of a picture projected on a screen

   B. light shining on a piece of metal

   C. plucking a guitar string

2. Plucking a guitar string:

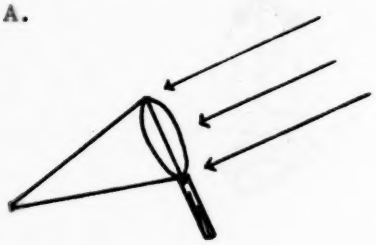
   A. gives off light rays

   B. causes a vibration

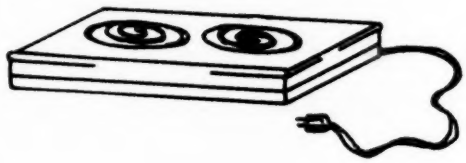
   C. causes evaporation

3. Which picture shows a sound being made?

A.



B.



C.

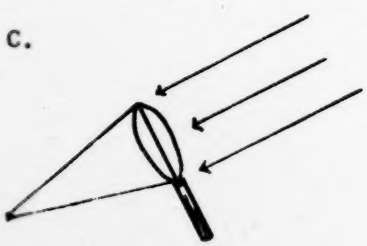
D.

4. Which picture does NOT show sound being made?

A.

B.

C.



D.

5. The boy in the picture is making:

A. sound

B. light

C. heat

6. Which of these is <u>always</u> true for sound?

A. It has a high pitch.

B. It travels in matter.

C. It is pleasant to hear.

D. It is loud.

7. Which of these is <u>NOT</u> always true for sound?

A. It is caused by vibrations.

B. It involves energy.

C. It travels in matter.

D. It has a high pitch.

8. A kind of energy which is caused by vibrations and travels only in matter is called:

A. heat

B. light

C. sound

D. electrical

9. Sound is:

   A. the process by which a solid changes to a liquid

   B. energy which is caused by vibrations and travels only in matter

   C. a force which is due to differences in air pressure

   D. matter which has a definite volume and takes the shape of its container

10. Sound is a kind of:

   A. gravity

   B. matter

   C. light

   D. energy

11. Which of these is a kind of sound?

   A. rolling

   B. loud

   C. valley

12. What is true for sound and a vacuum?

   A. Sound cannot travel in a vacuum.

   B. A vacuum is necessary for sound to travel.

   C. Heat can cause sound to travel faster in a vacuum.

   D. Sound can travel faster in a vacuum than it can in air.

THERMOMETER

1. The units for measuring temperature are:

   A. degrees

   B. inches

   C. minutes

   D. pounds

2. Degrees are the units used to measure:

   A. speed

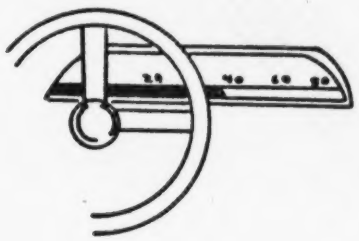
   B. time

   C. temperature

   D. weight

3. Which of these is a picture of a thermometer?

A.

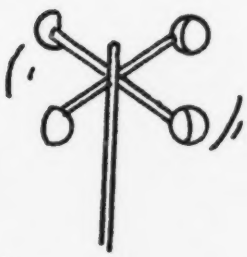


B.

C.

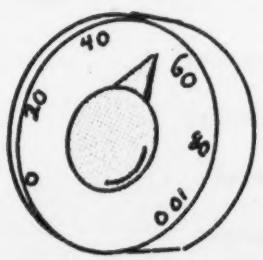
4. Which of these is NOT a picture of a thermometer?

A.

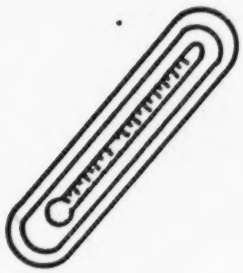


B.

C.



5. The picture shows a:



A. speedometer

B. clock

C. thermometer

D. anemometer

6. <u>All</u> thermometers:

A. measure temperature by the Fahrenheit scale

B. contain a liquid

C. measure high temperatures

D. measure temperature in degrees

7. Which of these is <u>NOT</u> true for all thermometers?

A. They measure temperature in degrees.

B. They are instruments.

C. They measure heat energy.

D. They contain mercury.

8. An instrument used for measuring heat energy is called a:

A. thermometer

B. speedometer

C. barometer

D. anemometer

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9. A thermometer is an instrument which is used for measuring:

   A. electricity

   B. air pressure

   C. heat energy

   D. light energy

10. A thermometer is a kind of:

   A. insulator

   B. energy

   C. instrument

   D. process

11. Which of these is a kind of thermometer?

   A. gravity

   B. liquid

   C. alarm

   D. spring

12. What is true for thermometers and expansion?

   A. Expansion of the conducting material in thermometers is caused by a change in air pressure.

   B. Thermometers are used to measure expansion of solids.

   C. An increase in temperature causes expansion of the conducting material in a thermometer.

   D. Changes in the relative humidity cause expansion of the conducting material in a thermometer.

Key

Correct Answers for Science Test Items

	TASK TYPES											
	1	2	3	4	5	6	7	8	9	10	11	12
Biological Science												
Bird	B	B	C	C	D	C	A	C	D	A	B	B
Cell	C	B	A	B	D	C	C	C	A	C	B	C
Fish	A	A	C	B	A	D	C	B	B	A	C	C
Heart (Human)	C	A	D	B	B	C	D	A	B	C	A	B
Invertebrate	A	B	A	A	A	A	C	B	D	A	C	D
Lens (Eye)	A	C	B	A	D	C	B	D	A	B	A	B
Lungs	A	B	A	B	D	C	A	A	D	B	B	C
Mammal	A	A	A	B	B	C	D	A	B	C	D	C
Muscle	C	A	B	A	C	B	A	A	D	A	A	C
Pore (Skin)	C	C	B	B	A	C	C	C	B	C	D	A
Earth Science												
Cloud	A	B	B	B	D	C	A	A	C	D	B	A
Core (Earth)	C	A	A	A	B	A	A	C	A	C	A	B
Fossil	C	C	A	B	A	D	B	B	A	C	A	C
Glacier	A	A	A	A	D	A	C	D	A	C	C	A
Meteor	A	A	B	B	A	D	B	A	A	B	C	B
Moon	A	C	A	B	B	A	A	A	B	B	A	A
Planet	A	B	A	A	D	C	B	A	C	C	B	C
Sedimentary Rock	B	B	C	A	D	B	B	C	A	B	D	C
Volcano	C	C	B	B	B	D	B	A	B	C	A	C
Wind	C	B	C	B	C	A	A	B	C	D	A	A
Physical Science												
Conductor	B	C	B	A	C	B	A	C	A	C	D	A
Evaporation	A	C	A	A	D	A	B	C	C	C	A	C
Expansion	A	B	B	B	B	A	A	D	C	C	B	B
Friction	A	C	B	A	C	B	B	C	B	D	A	A
Liquid	B	A	D	A	A	C	D	B	A	B	C	C
Melting	A	B	B	B	A	C	A	D	B	D	B	A
Molecule	A	B	B	B	B	C	A	C	B	A	B	C
Solid	A	B	C	B	A	B	B	B	A	D	C	B
Sound	C	B	D	C	A	B	D	C	B	D	B	A
Thermometer	A	C	C	A	C	D	D	A	C	C	B	C

REFERENCES

Frayer, D. A., Fredrick, W. C., & Klausmeier, H. J. A schema for testing the level of concept mastery. Working Paper from the Wisconsin Research and Development Center for Cognitive Learning, The University of Wisconsin, Madison, Wisconsin, April 1969, No. 16.

Harris, M. L. Some methodological suggestions for construction of an objective measurement instrument. Technical Memo from the Wisconsin Research and Development Center for Cognitive Learning, The University of Wisconsin, Madison, Wisconsin, December 1968, No. M-1968-2 (Revised).

Voelker, A. M., Sorenson, J. S.,& Frayer, D. A. An analysis of selected classificatory science concepts in preparation for writing tests of concept attainment. Working Paper from the Wisconsin Research and Development Center for Cognitive Learning, The University of Wisconsin, Madison, Wisconsin, No. 57, in press.

APPENDIX A

SOURCE OF SCIENCE CONCEPTS

The science concepts for which tests of concept mastery were written were selected from a list of concepts obtained by analyzing the third- and fourth-grade texts from the following series.

1. Blough, G. O., Marshall, J. S., Bailey, J. B., Beauchamp, W. L. Science is experimenting. Chicago: Scott, Foresman & Company, 1965.

2. Brandwein, P. F., Cooper, E. K., Blackwood, P. E., & Hone, E. B. Concepts in science. New York: Harcourt, Brace & World, Inc., 1966.

3. Jacobson, W. J., Lauby, C. J., & Konicek, R. D. Probing into science. New York: American Book Company, 1965.

4. MacCracken, H. D., Brown, R. A., Decker, D. G., Kuse, H. R., Sund, R. B., & Trowbridge, L. W. Science through discovery. New York: The L. W. Singer Company, Inc., 1968.

5. Mallinson, G. G., Mallinson, J. B., Steinberg, J. E., & Trexler, C. R. Science 4. Morristown, New Jersey: Silver Burdett Company, 1965.

6. Navarra, J. G., & Zafforoni, J. Today's basic science 4. New York: Harper & Row, 1967.

APPENDIX B

RESULTS OF ITEM TRYOUTS

Table B-1

Means, Standard Deviations and Reliabilities for Concept Mastery Tests--Biological Science: Pilot Test Data

AREA	$\bar{X}$	SD	REL
Biological Science:			
Bird **	10.32	1.58	.55
Cell ***	8.66	2.31	.61
Fish*	8.96	1.85	.54
Heart ***	10.17	1.90	.65
Invertebrate*	6.34	2.50	.63
Lens (Eye) ***	8.34	2.08	.54
Lungs ***	9.56	2.52	.77
Mammal*	8.31	2.90	.79
Muscle ***	8.58	2.52	.70
Pore (Skin) ***	9.37	2.29	.70

*N = 83 fifth grade subjects, Sussex, January, 1970
**N = 96 fifth grade subjects, Brookfield, April, 1970
***N = 102 fifth grade subjects, Brookfield, May, 1970

Table B-2

Means, Standard Deviations and Reliabilities for Concept Mastery Tests--Earth Science: Pilot Test Data

AREA	$\bar{X}$	SD	REL
Earth Science:			
Cloud **	9.85	1.98	.65
Core (Earth)**	9.54	1.75	.58
Fossil **	11.19	1.29	.62
Glacier **	9.23	2.05	.60
Meteor **	8.81	2.12	.58
Moon **	8.68	1.87	.65
Planet*	7.82	2.67	.72
Sedimentary Rock **	10.36	1.88	.68
Volcano*	8.66	2.44	.70
Wind **	9.91	1.58	.43

*N = 83 fifth grade subjects, Sussex, January, 1970
**N = 96 fifth grade subjects, Brookfield, April, 1970
***N = 102 fifth grade subjects, Brookfield, May, 1970

Table B-3

Means, Standard Deviations and Reliabilities for Concept Mastery Tests--Physical Science: Pilot Test Data

AREA	$\bar{X}$	SD	REL
Physical Science:			
Conductor ***	6.93	2.18	.54
Evaporation **	8.06	2.14	.63
Expansion ***	8.09	2.91	.78
Friction ***	8.03	2.11	.54
Liquid **	10.17	1.98	.70
Melting **	9.69	1.51	.42
Molecule ***	8.63	1.97	.51
Solid*	7.42	2.06	.53
Sound ***	9.55	1.88	.60
Thermometer ***	9.16	2.14	.64

*N = 83 fifth grade subjects, Sussex, January, 1970
**N = 96 fifth grade subjects, Brookfield, April, 1970
***N = 102 fifth grade subjects, Brookfield, May, 1970